usual in English works, and also in the curious guise of C. S. Clavio (p. 184.) Mention should also be made of the genitive forms of certain proper names. Shall we expect Wallis' or Wallis's, where the name is not a plural form? There is authoritative sanction for either, but there is no sanction for using the two forms indiscriminately as is the case with various names throughout this work.

With respect to the index there should be mentioned the fact that it is unusually complete and that it has one decided improvement over most efforts of this kind. This improvement consists in giving the most important reference first, and in the use of subtitles under the heading entries, each of which is a great convenience. There are various omissions, such as Coss, Harun al-Rashid, Fine (O., but see Orontius), and Salviati, and there are a few misspelled names, like Durege for Durège, but on the whole there is no reasonable cause for complaint.

In closing this review it should be said once more that the purpose of the writer has not been to find fault with respect to small details. He has endeavored to call attention to the distinctively good features of the work and to state only the leading features that are likely to be subjects of adverse criticism. If the proper limits of a review of this kind had permitted, he would have been glad to discuss such questions as the Roman use of 120 as a diameter, the rise of the sexagesimal fraction, and the causes of the prominence of mathematics in various epochs and in various countries, and to commend specifically certain other features of value. He wishes, however, to add the statement that the book shows a wide reading of secondary material and a considerable study of original sources. It will, of course, have a place in every mathematical library of any importance and will prove a helpful work of reference, particularly with respect to the mathematics of the last two centuries.

DAVID EUGENE SMITH.

Report of the President of the Carnegie Institution of Washington for the year ending October 31, 1919. Washington, D. C., 1919. 4to. 37 pp.

For the mathematician perhaps the most interesting items in this report by President R. S. WOODWARD, a charter member of the Association, are the paragraph concerning the Hooker telescope on Mount Wilson (pages 16–17) which "under repeated tests has proved efficient quite beyond the conservative theoretical predictions of attainable capacities," and the following paragraph (pages 18–19):

"The most elementary, the most essential, and hence the most widely used, if not esteemed, of the sciences is arithmetic. It is a fundamental requisite, in fact, of all exact knowledge. Ability to add, subtract, multiply, and divide affords probably the simplest test of capacity for correct thinking. Conversely, inability or indisposition to make use of these simple operations affords one of the surest tests of mental deficiency, as witnessed, for example, by numerous correspondents who are unable to or who refuse to apply these operations to the finances of the Institution. But the familiar science of arithmetic lies at the foundation also of a much larger and a far more complex structure called the theory of numbers. This theory has been cultivated by many of the most acute thinkers of ancient and modern times. It has more points of contact with quantitative knowledge in general than any other theory except the theory of the differential and

integral calculus. These two theories are complementary, the first dealing with discrete or discontinuous numbers and the second with fluent or continuous numbers. Naturally, a subject which has attracted the attention of nearly all of the great mathematicians of the past twenty centuries has accumulated a considerable history. The more elementary contributions of Euclid, Diophantus, and others of the Greek school; the extensions of Fermat, Pascal, Euler, Newton, Bernoulli and many others in the seventeenth and the eighteenth centuries; and the work of Lagrange, Laplace, Gauss, and their numerous contemporaries and successors of the nineteenth century, make up an aggregate which has stood hitherto in need of clear chronological tabulation and exposition. This laborious task was undertaken about ten years ago by a Research Associate of the Institution, Professor Leonard E. Dickson, of the University of Chicago. A publication under the title 'History of the Theory of Numbers' has resulted, and volume I (8vo, xii + 486 pp.), devoted to divisibility and to primality of numbers, has appeared during the past year; and a second volume devoted to diophantine analysis is now in press. This work is remarkable for its condensation of statement. It contains more information per unit area than any other work issued thus far by the Institution. It is remarkable also for the care taken by the author and by his collaboration to secure precision and correctness, a number of experts having assisted in the arduous labors of verification required during the process of printing."

Two sections, completing volume 9, of the great *New English Dictionary on Historical Principles* (cf. *1919*, 256–257) were published by the Clarendon Press, Oxford, in August, 1919. They cover the portions Stratus-Styx, Sweep-Szmikite. The longest article in the sections is that on the verb 'strike' (29 columns). One interesting point here brought out is that the use of 'strike' in the sense 'to refuse to work' is an eighteenth century development from the nautical use in 'to strike a mast' (*Annual Register*, 1768; p. 92: "A body of sailors . . . proceeded . . . to Sunderland . . . and at the cross there read a paper, setting forth their grievances. . . . After this they went on board the several ships in that harbor and struck (lowered down) their yards, in order to prevent them from proceeding to sea.").

Other terms of interest to the mathematician (with indications of some of the earliest dictionary references) are: stream-line (in hydrodynamics, Maxwell; *Electricity and Magnetism*, 1873); strophoid (W. W. Johnson in *Amer. Journal of Math.*, 1880[1]); striction (line of striction, Frost, *Solid Geometry*, 1875, p. 297); sturmian (Sylvester, *Philosophical Trans.*, volume 143, 1853); style (Leybourn, *Cursus Mathematicus*, 1690, p. 704—the line shadow on the plane of the dial showing the true hour-line); symbolic, symbolical, symbolically; symmedian[2] (Casey, *Analytical Geometry*, 1885, pp. 45, 247); symmetral (Jeake, *Arithmetic*, 1674, p. 295 "Commensurable, called also Symmetral, is when the given Numbers have a Common Divisor" also "Symmetral Surdes" [obsolete uses]—Gurney, *Crystallography*, 1878, p. 27 "The two halves on either side of this symmetral plane are in all respects similar"); symmetric, symmetrical; symmetroid (Cayley's name for a certain surface of the fourth order, 1870, *Coll. Math. Papers*, Vol. 7, p. 134); symmetry; synchronism, synchronous curve (Brande and Cox, *Dict. Sci.*, 1867); synclastic (Thomson and Tait, *Nat. Phil.*, vol. 1, part 1, 1867, § 128 "We may divide curved surfaces into Anticlastic and Synclastic. A saddle

[1] The term strophoïde seems to have been used for the first time by Montucci in 1846 (*Nouv. Annales de Math.*, vol. 5, p. 470); it was called the logocyclic curve by James Booth (*Treatise on some new Geometrical Methods*, vol. 1, 1873, p. 295).

[2] The French equivalent of this term, "symédiane," was invented by M. D'Ocagne (*Nouv. Annales de Math.*, October, 1883, p. 451) as an abbreviation for "symétrique de la médiane."

gives a good example of the former class; a ball of the latter"); synectic (B. Williamson in *Encycl. Brit.* vol. 24, 1888, p. 72 "A function of a complex variable which is continuous one-valued, and has a derived function when the variable moves in a certain region of the plane is called by Cauchy Synectic in this region"); syntax; syntheme (Sylvester, 1844, *Coll. Math. Papers*, 1904, vol. 1, p. 91 "Let us agree to denote by the word syntheme any aggregate of combinations in which all the monads of a given system appear once and once only. . . . Let us begin with considering the case of duad synthemes"); synthetic; syntractrix and syntractory (G. Peacock, *Examples Diff. Calc.*, 1820 and G. Salmon, *Higher Plane Curves*, 1852); systatical (Jeake, *Arithmetic*, 1674, p. 662 "Three . . . is called a Systatical or Substantial Number, because all Sublimary Bodies consist of the three principal Substances, Sal, Sulphur, and Mercury") [obsolete]; syzygant; syzygetic and syzygy (Sylvester, *Cambr. and Dublin Math. Journal*, vol. 5, 1850, p. 276 "The members of any group of functions, more than two in number, whose nullity is implied in the relation of double contact, . . . must be in syzygy. Thus, *PQ*, *PQR*, *QR*, must form a syzygy").

It may be remarked that the editors of 'N.E.D.' have overlooked three words used in mathematical literature, namely: symptose, syntypic, and syrrhizoristic. The first two occur in the index to Cayley's *Coll. Math. Papers*, 1898, on p. 135. (The use of the term syntype, in natural history, *is* presented in 'N.E.D.'). Sylvester introduced the word syrrhizoristic (*Philosophical Trans.*, vol. 143, 1853, and *Coll. Math. Papers*, vol. 1, p. 585 "A syrrhizoristic series is a series of disconnected functions which serve to determine the effective intercalations of the real roots of two functions lying between any assigned limits").

While 'N.E.D.' lists several meanings of the word systatic, there is no reference to its use in mathematics. Have this word and asystatic (not in 'N.E.D.') ever been used as mathematical terms in English writings? They are familiar to the Frenchman (*Encyclopêdie des sciences mathematique*, tome 2, volume 4, p. 224: "groupes systatiques et asystatiques"), to the German (Lie-Engel, *Transformationsgruppen*, Band 1, Leipzig, 1888, Kapitel 24: "Systatische und asystatische Transformationsgruppen," pp. 497–522), and to the Italian (L. Bianchi, *Lezioni sulla teoria dei gruppi continui*, Pisa, 1918, p. 185: "gruppi sistatici ed asistatici").

The Physical Society of London. *Report on the Theory of Gravitation.* By A. S. EDDINGTON, London, Fleetway Press, 1918. 8vo. 7 + 91 pp. Price, in paper, 6s. 3d.

Quotation from the Preface: "The relativity theory of gravitation in its complete form was published by Einstein in November, 1915. Whether the theory ultimately proves to be correct or not, it claims attention as one of the most beautiful examples of the power of general mathematical reasoning. The nearest parallel to it is found in the applications of the second law of thermo-dynamics, in which remarkable conclusions are deduced from a single principle without any inquiry into the mechanism of the phenomena; similarly, if the principle of equivalence is accepted, it is possible to stride over the difficulties due to ignorance of the nature of gravitation and arrive directly at physical results. Einstein's theory has been successful in explaining the celebrated astronomical discordance of the motion of the perihelion of Mercury, without introducing any arbitrary constant; there is no trace of forced argument about this prediction. It further leads to interesting conclusions with regard to the deflection of light by a gravitational field, and the displacement of spectral lines on the sun, which may be tested by experiment.